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July 25, 1968

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Attn: Hank D.

Dear Hank:

By now Faye should have left and the interesting "edge effects" project on which she worked has probably come to a standstill, at least for the time being. My recent thoughts on trying to complete her work just for its own sake rather than any end-use has led me to believe that there may indeed be a very useful end-product arising from her studies. If theory can be substantiated by measurements of the kind she proposed recently, namely the technique of spectral edge tracing, this may be the nucleus of a valuable tool for assessing the quality of the processing of a given piece of film. This assessment could be made on any film without regard to a knowledge of the processing conditions. It would provide a natural adjunct to the edge-trace analysis technique for assessment of mission quality through MTF derivation.

With your permission, I would like to summarize in the next few paragraphs our thinking on this edge-effects project, and in so doing, lead into my latest thoughts on its practical application.

It is well known that under certain processing conditions which are generally termed "poor", degradation of image edges is seen to occur. A microdensitometric trace of such a degraded edge is shown schematically in Diagram 1.

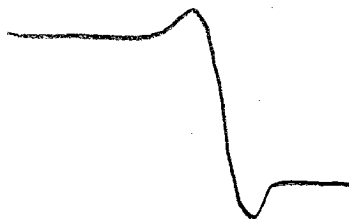


Diagram 1

These edge effects (or adjacency effects as they are sometimes known) are caused by the differential rates of the developing reaction which occurs in the vicinity of an edge. Under normal processing conditions, reactant starvation or product build-up is minimized by the use of concentrated developers and strong agitation. These edge effects are therefore associated with poor agitation and depleted or dilute developers.

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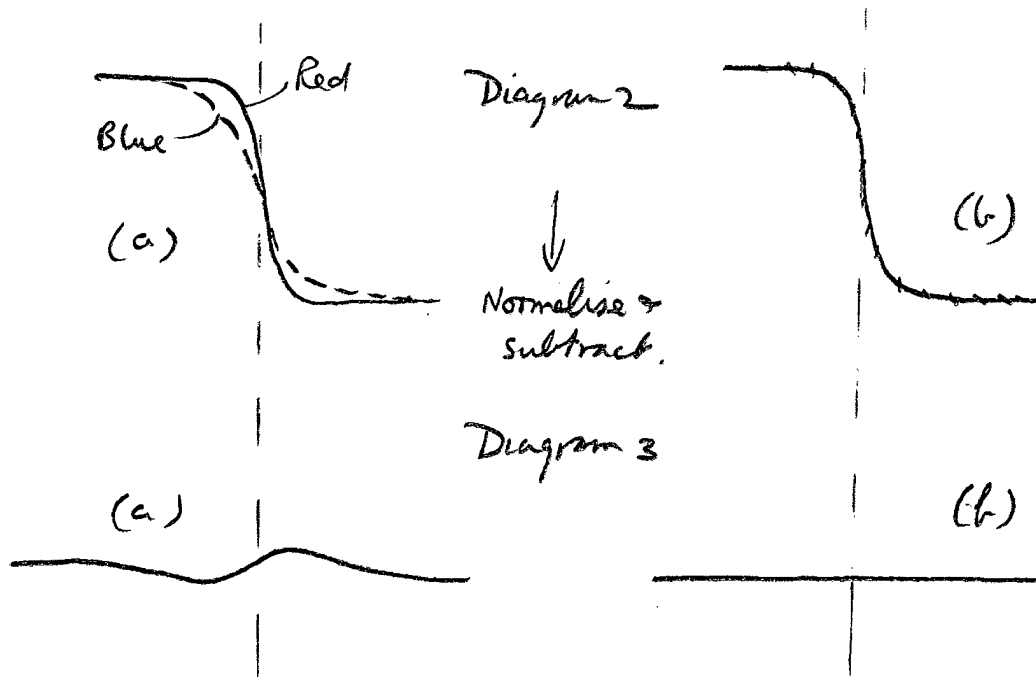
- 2 -

It is evident that in the vicinity of the edge the developer composition is likely to differ radically from that determined by analysis of the bulk solution. It is also known that the developer composition determines the relative contributions of physical and chemical development. It was pointed out in your laboratories that this change in the ratio of physical/chemical development as one progresses across an edge should be measurable by changes in spectral density, i.e. the density trace across the edge if measured in blue light would differ from that measured in red light.

It appears that this is the present status of the study. Further work on this project seems unlikely due to the extended leave of absence of your principal researcher (Faye).

I have examined the feasibility of modifying the Joyce-Loebl microdensitometer so that it will be possible to measure densities at  $7000\text{\AA}$  and  $4000\text{\AA}$ . This modification appears to be very minor, the principal cost being a different photomultiplier tube. Therefore there seems to be no technical reasons why the project could not be completed by us and presented as a joint effort.

The project as originally conceived was an investigation into the utility of edge effects either in the improved delineation of images, or in providing more well defined edges for mensurational purposes. Faye's pure research spirit soon carried her beyond these original intentions and for some time we were concerned as to the eventual practicality of her work. On considering the microdensitometer experiment that she has proposed, it seems to me that if one could indeed demonstrate the differences in spectral density across a poorly developed edge that theory predicts, then one has the nucleus of a very useful analytical tool. Consider two traces of the same edge, one made with red light and one with blue light (Diagram 2). If one normalized both traces and subtracted one from the other, then if there is a difference, we see a curve like Diagram 3(a).

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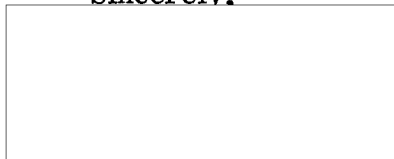
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If the processing is good, then the two traces are coincident and the derivative is a straight line (Diagram 3(b)). Thus by such a double trace on any edge in an image, one could determine the quality of the processing which produced that image. The mechanics of the operation would be very similar to the MTF edge trace method for rating mission quality.

I would be pleased to discuss this in greater detail if you think the technique has any merit. In the meantime I would really appreciate reading Faye's final report on the subject.

Sincerely.



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JFH:amt

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September 4, 1968

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Attn: Hank D.

Dear Hank:

As we discussed in your laboratory on August 29, we will be undertaking a program to complete the Edge Effects Project initially studied in your lab by

[redacted] project on the study of adjacency and edge effects led her to believe that in the vicinity of a developed edge there is a change in the morphology of the developed silver. This non-uniformity is derived from the unsymmetrical depletion of developer and build up of developer products. The shape and size of developer silver particles influences the spectral characteristics of the density it imparts. Let us consider then the result of measuring the density across an edge at two widely different wavelengths; if non-uniformity of development were present, there should be differences in the nature of the traced edges. The extent to which traces in blue light and red light differ would be some measure of the processing conditions and could provide a valuable tool for rating processing quality.

In order to test this hypothesis, we propose to modify a Joyce Loeb microdensitometer here at Tech/Ops so that it can trace at 4000 Å and at 7000 Å. The direct labor cost for this will be approximately \$700.

We then propose to process selected films under conditions where edge effects should be present, and trace them in the manner described. At the end of about three months, it should be possible to establish whether or not the concept originally proposed by [redacted] was valid. It should also be possible at that time to evaluate the practical use of the technique for determining processing quality. The direct labor cost for this work will be approximately [redacted]. The costs mentioned here will be equitably spread between the Image Analysis and the Coherent Technology (time and material) programs.

Should the first phase of this program prove to be positive, a second phase lasting three months should be initiated to make the techniques routine.

Sincerely yours,

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